CLAIMS

1. A dispersion compensator, comprising:

an array waveguide grating having a plurality of array waveguides that each have an effective length;

a component configured to receive portions of a light signal from the array waveguide grating and combine portions of the light signal into an output light signal having a dispersion profile; and

at least a portion of the array waveguides including effective length tuners for tuning the effective lengths of the array waveguides such that the dispersion profile of the output light signal is tuned.

2. The compensator of claim 1, wherein each effective length is configured to change the temperature of an array waveguide.

3. The compensator of claim 1, wherein each effective length tuner is configured to drive a current through an array waveguide.

4. The compensator of claim 1, wherein the effective length tuners are integrated into a common effective length tuner positioned adjacent to a plurality of the array waveguides.

5. The compensator of claim 1, wherein the array waveguides are associated with an array waveguide index j, and the effective length tuners are configured to be tuned such that the amount of the effective length change for the array waveguides is an exponential function with a base that is a function of the array waveguide index.

6. The compensator of claim 5, wherein the exponential function includes:

$$\beta(j + C)^{\alpha}$$

C and α being constants and β having a value that changes in response to tuning of the effective length tuners.

7. The compensator of claim 6, wherein α is about 2.

8. The compensator of claim 6, wherein α is greater than 2.

9. The compensator of claim 1, wherein the array waveguides are associated with an array waveguide index j, and further comprising:

electronics for tuning the effective length tuners such that the amount of the effective length change for the array waveguides is an exponential function with a base that is a function of the array waveguide index.

10. The compensator of claim 9, wherein the exponential function includes:

$$\beta(j + C)^{\alpha}$$

C and α being constants and β having a value that changes in response to tuning of the effective length tuners.

11. The compensator of claim 10, wherein α is about 2.

12. The compensator of claim 10, wherein α is greater than 2.

13. The compensator of claim 1, wherein the array waveguides are associated with an array waveguide index j, and

the effective length tuners have an effective area length extending along a length of an array waveguide, the effective area lengths being an exponential function with a base that is a function of the array waveguide index.

14. The compensator of claim 13, wherein the exponential function includes:

$$B(j + C)^{\alpha}$$

wherein B, C and α are constants.

15. The compensator of claim 1, wherein the component has an input side and an output side, the array waveguide grating being connected to the input side and the array waveguides have lengths selected such that light signals of different wavelengths are incident on different regions of the output side.

16. The compensator of claim 1, wherein the component has an input side and an output side, the array waveguide grating being connected to the input side and the array waveguides have lengths selected such that light signals of different wavelengths are each incident on a region of the output side.

17. The compensator of claim 1, wherein the component has an input side and an output side, the array waveguide grating being connected to the input side and the array waveguides have lengths selected such that a dispersion profile of the input light signal is different than the dispersion profile of the output light signal.

18. The compensator of claim 1, wherein the array waveguides are associated with an array waveguide index j, and the lengths of the array waveguides including one or more exponential functions having a base that is a function of the array waveguide index j.

19. The compensator of claim 18, wherein the exponential function includes:

$$\delta(j + C)^{\varepsilon}$$

where C, δ and ε have a constant value.

20. A dispersion compensator, comprising:

an array waveguide grating including a plurality of array waveguides having an effective length and being configured to receive a portion of an input light signal;

at least a portion of the array waveguides having effective length tuners for tuning the effective lengths of the array waveguides; and

an output waveguide configured to receive at least a portion of the input light signal portions, the received input light signal portions being combined into an output light signal having an output dispersion profile, the output dispersion profile changing in response to tuning of the effective length tuners.

21. The compensator of claim 20, wherein each effective length tuner includes a device for changing the temperature of an array waveguide.

22. The compensator of claim 20, wherein the effective length tuners are configured to drive a current through an array waveguide.

23. The compensator of claim 20, wherein the effective length tuners are integrated into a common effective length tuner positioned adjacent to a plurality of the array waveguides.

24. The compensator of claim 20, wherein the array waveguides are associated with an array waveguide index j, and the effective length tuners are configured to be tuned such that the amount of the effective length change for the array waveguides is an exponential function with a base that is a function of the array waveguide index.

25. The compensator of claim 20, wherein the array waveguides are associated with an array waveguide index j, and further comprising:

electronics for tuning the array waveguides such that the amount of the effective length change for the array waveguides is an exponential function with a base that is a function of the array waveguide index.

26. The compensator of claim 20, wherein the number of array waveguides is equal to N and the array waveguides are associated with an array waveguide index j where j = 1 through N; and

the effective length tuners each have an effective area length extending along a length of an array waveguide, the effective area lengths being an exponential function with a base that is a function of the array waveguide index.

27. The compensator of claim 20, wherein the output waveguide is one of a plurality of output waveguides and the array waveguides having lengths selected such that different output waveguides receive portions of the input light signals having different wavelengths.

28. The compensator of claim 20, wherein the array waveguides have lengths selected such that the output waveguide receives portions of the input light signals having different wavelengths.

29. The compensator of claim 20, wherein the array waveguides are associated with an array waveguide index j, and the length of the array waveguides includes one or more exponential functions having a base that is a function of the array waveguide index j.

30. A dispersion compensator, comprising:

an array waveguide grating having a plurality of array waveguides that each have an effective length, the array waveguides being configured to carry portions of an input light signal;

a component configured to receive the portions of the input light signal from the array waveguide grating and to combine the portions of an input light signal into an output light signal having a dispersion profile;

at least a portion of the array waveguides including effective length tuners for tuning the effective lengths of the array waveguides; and

electronics for tuning the effective length tuners such that the dispersion profile of the output light signal changes.

31. The compensator of claim 30, wherein the array waveguides are associated with an array waveguide index j, and the electronics are configured to tune the effective length tuners such that the amount of the effective length change for an array waveguide is an exponential function with a base that is a function of the array waveguide index.

32. The compensator of claim 31, wherein the exponential function includes:

$$\beta(j + C)^{\alpha}$$

C and α being constants and β having a value that changes in response to tuning of the effective length tuners.

33. The compensator of claim 32, wherein α is about 2.

34. The compensator of claim 32, wherein α is greater than 2.

35. A method of tuning the dispersion profile of a light signal, comprising:

combining portions of a light signal that exit an array waveguide grating into an output light signal having a dispersion profile, at least a portion of the array waveguides having a tunable effective length; and

tuning the effective length of the array waveguides such that the dispersion profile changes.

36. The method of claim 35, wherein the array waveguides are associated with an array waveguide index, j, and the effective length of the array waveguides are tuned such that an amount of effective length change for an array waveguide is an exponential function with a base that is a function of the array waveguide index.

37. The method of claim 36, wherein the exponential function includes $\beta(j + C)^{\alpha}$, C and α being constants and β having a value that changes in response to tuning of the effective length tuners.

38. The method of claim 37, wherein α is about 2.

39. The method of claim 37, wherein α is greater than 2.

40. The method of claim 37, wherein C is a function of the total number of array waveguides.